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The Elements of the Global Network for Large-Value Funds Transfers

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The views expressed in this paper are those of the author. No responsibility for them should be attributed to the Bank of Canada.

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Abstract

The author describes the various elements of the global payment network for large-value funds transfers (G-LVTN) in order to provide a convenient reference document intended for readers in the academic, legal, and financial communities. The short form G-LVTN is used to name the totality of the relevant national payment systems and cross-border banking arrangements that comprise the global whole. Policy issues relevant to the G-LVTN that have arisen over the last decade are summarized, as are the principal actions taken by central banks and others to address those issues. The paper concludes by examining three trends that are affecting the processing of substantial cross-border funds transfers, and how those trends may affect the global network in the future.

JEL classification: E40, E61
Bank classification: Payments, clearing and settlements systems

Résumé

Dans ce document de référence utile, rédigé à l'intention des milieux universitaires, juridiques et financiers, l'auteur décrit les diverses composantes du réseau mondial de transfert de paiements de grande valeur. L'acronyme anglais G-LVTN y est utilisé pour désigner l'ensemble des systèmes nationaux de paiement pertinents et des arrangements bancaires transfrontières qui composent le réseau mondial. L'auteur donne également un aperçu des questions de politique que le réseau a soulevées durant les dix dernières années ainsi que des principales mesures prises par les banques centrales et d'autres institutions à cet égard. En conclusion, il examine trois tendances qui influent sur le traitement des importants transferts de fonds transfrontières ainsi que leurs répercussions possibles sur le réseau mondial dans l'avenir.

Classification JEL : E40, E61
Classification de la Banque : Systèmes de paiement, de compensation et de règlement

1. Introduction

The principal objective of this working paper is to describe the various elements involved in making cross-border large-value payments in a single document. It is written for readers in the academic, legal, and financial communities. The acronym G-LVTN, short for global large-value transfer network, is used in the paper to name the totality of the relevant national payment systems and cross-border banking arrangements that comprise the global whole. Policy issues relevant to the G-LVTN that have arisen over the last decade are summarized, as are the principal actions taken by central banks and others in order to address these issues. The working paper concludes by examining three trends that are affecting the processing of cross-border funds transfers, and how these trends may affect the global network in the future.

The paper builds on two statements that also attempted to describe the making of cross-border payments in terms of a global whole. The first is contained in a Bank for International Settlements (BIS) report (BIS 1990a). Its introduction section includes a number of seminal ideas, including the concept that "the global payment system is in effect created by a complex web of banks and other institutions." The second statement was made by D. Beau of the Banque de France and J. Stehm of the U.S. Federal Reserve Board, members of the BIS Committee on Payment and Settlement Systems (CPSS) in 1999; they suggested that large-value transfer systems within countries form a loose payments network bound together globally by correspondent banking arrangements.

Section 2 of this working paper describes a basic example of a cross-border funds transfer, namely a Japanese importer paying for a shipment of lumber moving from North America. It shows how a commercial trade transaction is often preceded and followed by the purchase (or sale) of foreign exchange, money-market transactions such as the investment (or disinvestment) in term deposits, or the purchase (or sale) of securities—and how many of these treasury-management transactions cause other payments to flow between pairs of banks. The example describes the decision-making processes that lead to large-value transfers, and it helps explain the massive scale of financial transactions relative to commercial transactions. Section 3 describes the main types of cross-border banking arrangements, with the traditional relationship between a bank and its correspondent institution in another country being an important, although increasingly dated, example. Section 4 briefly describes the particular national large-value transfer systems that convey the majority of the international transactions of both banks and their clients around the world.

Section 5 presents two estimates of the monetary value and volume (i.e., number) of the cross-border payments flowing through the G-LVTN on a typical day. These rough estimates

suggest that the daily average value of such payments was some US$3–$5 trillion in 1997. There were approximately 1 million large-value cross-border transfers per day in the network at that time. Section 6 discusses temporal elements of the G-LVTN, such as time zones and national business hours.

The two subsequent sections address the public-policy dimension of the global network. Section 7 attempts to articulate the characteristics of a "good" payment system for large cross-border transfers. Section 8 surveys the five main policy initiatives that have occurred in this context over the last decade, noting how they work to enhance the soundness of the infrastructure.

Finally, Section 9 examines three interrelated trends: (i) globalization, (ii) the increasingly intense application of information technology, and (iii) the continuing consolidation among the banking institutions that facilitate cross-border large-value funds transfers. The paper concludes with a suggestion regarding future work on the G-LVTN.

2. A Basic Example of a Large-Value Cross-Border Payment

Consider as a concrete example a payment being made by a Japanese importer of lumber from North America. Such commodity trade transactions typically require that payment be made in U.S. dollars. (About two-thirds of all transactions involving international trade contracts use this unit of account.) The U.S. dollar is thus regarded as the main "vehicle" currency for the cross-border payments associated with world trade and finance.

The Japanese importer must make a number of calculations and decisions before initiating the payment. On what day—indeed at what hour—should the importer purchase any needed dollars? When and under what trade terms does the supplier of lumber require payment? How do the likely payment dates relate to the volatile periods for exchange rates that often occur at month-ends and banking year-ends? Should the importer hedge against a rise in the exchange value of the dollar? Or perhaps speculate? Should the importer buy dollars early and invest them over the short run, or delay the purchase of dollars—even well past the value-date—and in the meantime borrow the U.S. funds needed to make the payment? After these decisions have been made and acted upon, the Japanese corporation will either own the needed dollars, or will have committed to purchase or borrow them, usually for effect on the same day as the planned payment to the supplier of the lumber.

How exactly does the Japanese corporate officer then transfer money to the North American seller of the lumber? The transfer must deliver U.S. dollars in the form of a claim on a bank (not bank notes) to the seller, and it follows that the corporation's bank must somehow gain access to the U.S. payment system. To achieve this, the transfer typically moves along a chain of correspondent

banks. It starts when the Japanese corporate officer authorizes the transfer, often by computer-to-computer communication with the officer's bank in Japan. The officer identifies the supplier of the lumber, and the lumber corporation's bank—say in Seattle. The officer's own bank then sends what is called a credit-transfer message, and the message is typically routed to that institution's correspondent bank in New York City, almost always a participant in the relevant U.S. payment system—the Clearing House Interbank Payments System (CHIPS). The message from Japan to New York typically moves via the telecommunications facility run by the Society for Worldwide Interbank Financial Telecommunications (SWIFT)—a cooperative established under Belgian law in 1973, and now involving about 7,000 banks and other financial institutions throughout the world.

The initial credit-transfer message will, on the same day, cause a movement of funds from New York to the identified bank in Seattle. Before the money gets there, yet another bank is likely to be involved because the New York correspondent of the Japanese bank will communicate with a second U.S. bank, namely the New York City correspondent of the Seattle bank. Thus there can be as many as four banks handling the importer's payment, with each one likely to experience a receipt, then a disbursement, of the dollar amount involved. These generally equal flows all take place within the same calendar day, and all within the same clearing cycle of the U.S. payment system. If everything works out as expected, the "net" positions of the various institutions facilitating the importer's payment should be zero (because of subtracting outflows from inflows). But if one link in the chain of correspondent banks has a problem in fulfilling its part of the process, the problem may well be shared by the other banks further along the chain if they (or their clients in turn) have already acted on the assumption of a payment being received. (See subsection 8.2 for a well-known example.)

The above example illustrates two important distinctions: (i) the Japanese importer's payment is made to buy goods or services, not to buy foreign exchange, and (ii) the importer's payment is a "third-party payment," as opposed to an "interbank" payment. (The decision by the Japanese importer—being one of the third-party clients of the banks involved—to pay dollars for the shipment of lumber today may well have been preceded by a quite separate foreign exchange purchase transaction, one in which the importer made a payment in yen that was routed to a seller of dollars.) As the Japanese importer's transfer moves along the chain of institutions to reach the ultimate beneficiary's account, there are the various correspondent bank interchanges that are of course "interbank" by their very nature. Distinctions such as these prove useful in designing risk-control structures, because the needs and behaviours of the various actors can be kept clearly in mind. Moreover, the payment-related archival data generated by SWIFT are divided into two

categories according to whether a payment is a third-party or an interbank transaction, hence supporting research on the global flows of payments.

One empirical observation can be made by using this example: As described, the primary commercial payment transaction of the importer typically proliferates a substantial number of secondary and tertiary financial transactions and payment transfers. Before, during, and after the purchase of a commodity, there are exchange market, money market, and derivative market transactions as various players conduct their affairs in ways that they view as balancing the tasks of maximizing profits and minimizing risks. It is notable that for every million dollars in commercial trade transactions such as the lumber purchase, there are at least *100 times* this dollar amount in additional (largely) financial transactions and payments. (The factor of 100 can be easily verified by dividing one of the global payment measurements described in Section 5 by either total world exports or total world imports.)

3. Common Types of Cross-Border Banking Arrangements

The example of a payment by a Japanese importer of lumber from the United States illustrated the fact that the global network for large cross-border funds transfers is composed of national large-value payment systems such as CHIPS, plus numerous banking arrangements operating both across borders and within countries. This section brings together material describing both traditional and contemporary types of such arrangements.

3.1 The correspondent/respondent relationship

Correspondent banking relationships traditionally have involved one bank providing one or more services to another bank under a contractual arrangement so as to permit the latter institution and its clients to make and receive the cross-border payments necessary in international trade and finance. The bank that provides the services is called the *correspondent* bank; the other institution is called the *respondent* bank. Usually, the correspondent bank is a direct participant in its nation's large-value payment system most oriented to cross-border transactions. The contractual relationship is almost always reciprocal: the correspondent will use its respondent for transfers destined to the country of, and denominated in the national currency of, the latter. To avoid switching costs, reduce credit-risk monitoring costs, and reduce information costs in both the interbank and bank-to-client contexts, banks have often maintained the same bilateral relationships for many years. Recent trends are, however, leading to changes. For example, widespread mergers of banks are tending to involve some degree of rationalization of correspondent relationships, because usually only one correspondent per country is needed. In a

similar manner, the European Union's common currency has made various long-standing correspondent relationships redundant, since only one correspondent is needed to handle euro-denominated payments in the 15 countries. (Some implications of such developments in correspondent banking arrangements are examined in Section 9.)

3.2 Using a branch or subsidiary in a foreign country

The most common alternative to the use of a correspondent bank to support cross-border payment services is the establishment of a branch or subsidiary in one or more countries where a bank or its clients are active. This option may become attractive when the foreign activities of the bank reach a certain scale and it becomes economically feasible. In using its branch or subsidiary, the bank saves the fees and other requirements that would otherwise be owed to a correspondent bank. But it must develop local knowledge, set both staff and operating structures in place, and establish the necessary links to the relevant national payment system. In addition, it becomes subject to local supervision. The use of a subsidiary means that there is a legal entity unambiguously subject to local laws, one that has its own financial capital, its own accounts, as well as being regulated and supervised by the host-country authorities. Branches may maintain their own separate books, they may be to some extent supervised locally, but the primary supervisory responsibility rests with the home-country regulator.[1]

3.3 Participation by remote access

Another alternative is the use of remote access; i.e., bank staff in one country use computers and telecommunications technology to conduct transactions in the payment system of a second country. (One can see rough parallels to both teleworking and to Internet banking.) The practice made increasingly good sense in the European context once the unified banking regulations were established because all the banks in each European Union country had gained full banking status in every other European Union country. A broadly comparable development has occurred in the United States. A decade ago, the access criteria stated in the CHIPS rules required that a participating institution transmit its payment messages through a primary connection located in New York City, and that it have an officer authorized to make binding commitments physically present in New York when CHIPS was operating. In subsequent years, the first requirement was gradually eased, and currently the participants' computer facility can be located anywhere in the world, conditional upon a demonstration that the remote access arrangement is reliable. The

1. See BIS (1983). This document was a revised version of the "Basle Concordat" of 1975. See also BIS (2001, section 9.2).

second requirement in the rules now states that the authorized officer must be located somewhere in the United States. These European and American examples clearly illustrate a characteristic of the evolution of the global arrangements: the increasingly intense application of information technology. (Section 9 elaborates.)

The three types of cross-border banking arrangement described thus far could all be drawn in the form of a *star*. The three arrangements are decentralized, and they rely heavily on bilateral connections between pairs of banks, rather than the use of some central party or facility. In contrast, the two arrangements that follow could be drawn as a *hub and spokes*. They are centralized, and all participating banks' messages are processed through a single agency. It may be the case that the centralized type of cross-border arrangement achieves greater efficiency—without unduly increasing operational, credit, or jurisdictional risks.

3.4 Access to Europe via Euro 1

Upon the creation of the European Monetary Union, major banks around the world needed to decide how to make large-value payments denominated in euro, and how to consolidate their various correspondent relationships in the countries that were using the new common currency. In many cases, their answer was to use the descendant of the former European Currency Unit netting mechanism. (The ECU clearing and settlement system was established by the ECU Banking Association in 1986.) The descendant was called Euro 1, with the "1" indicating large-value transfers, as opposed to retail or small-value payment transactions, which may eventually be handled in a second phase.

The Euro 1 is a large-value payment netting mechanism for transfers denominated in euros. Each credit-transfer message among participating institutions is copied automatically by the SWIFT network, and the copy is routed to computers operated by SWIFT as input for a multilateral calculation of each institution's gain or loss, known as its net debit or credit position. At the close of operations each day, participants in a net debit position must initiate a payment to the European Central Bank (ECB) in that amount of euros. Subsequently that evening, when all the debit positions have been accounted for, the ECB will route a payment to each participant that is in a net credit position for the amount of euros due. The participants in Euro 1 are therefore able to make euro payments to any other participating bank in any European country (or elsewhere)—with no correspondent at all. Over 100 banks, including many from overseas countries, have decided to function in this manner (Dowson 1997–98).

3.5 Access to Europe via euroSIC

In a broadly similar fashion to the developments described in the last subsection, the emergence of the European common currency required the major Swiss banks to decide how they would make large-value payments denominated in euros, and how to consolidate their various correspondent relationships in the countries that were using the new common currency. Several banks chose a cooperative solution,[2] and set up the euroSIC, which can be viewed as a clone of the Swiss Interbank Clearing (SIC) system.

To develop the euroSIC, the participating Swiss banks established a specialized bank in Frankfurt—the Swiss Euro Clearing Bank (SECB)—to be their principal correspondent for euro-denominated payment transactions. The Swiss banks essentially duplicated the software of their national large-value transfer system—the Swiss Interbank Clearing system—using the clone, which is called euroSIC, to receive, risk-control, forward, net, and settle credit transfers denominated in euro. The SECB provides access to the Trans-european Automated Real-time Gross settlement Express Transfer (TARGET)[3] system for transfers destined outside Germany but inside the European Union. TARGET is the large-value transfer system for euro-denominated payments operated by the European Central Bank.

The euroSIC is impressive for several reasons. It leads to pooling and netting efficiencies for the Swiss banks; e.g., a lower average level of euro balances held at the SECB compared with the sum of the numerous earlier correspondent balances owned by members of the Swiss group and scattered across Europe in numerous correspondent banks. Moreover, the centralized and highly automated structure provides for intraday risk control on a real-time, payment-by-payment basis. The services of the euroSIC can be sold to other banks around the world and, indeed, have recently been sold to a small number of Austrian banks. (See also subsection 8.3 concerning the private settlement asset and the reduction of payment-system risk.)

4. Some National LVTSs Functioning as Elements of the G-LVTN

The earlier example of a cross-border payment by a Japanese importer of lumber from the United States (presented in Section 2) referred to CHIPS as the U.S. payment system through which the credit transfer would pass. Similarly, in many other countries there is one preferred system for the processing of cross-border payments. This section describes briefly seven such systems, ordered

2. More precise terminology for "cooperative solution" would be "club solution." See Ostrom (1990).
3. The use of TARGET by the euroSIC is described in *Euro Swiss Interbank Clearing - euroSIC*, http://www.eurosic.com.

by time zone from east to west, identifying both the type and its lead developer.[4] If correspondent banking and the innovative cross-border relationships described in the preceding section form the *links* of the global network, then these major national payment mechanisms form the *nodes* of the G-LVTN.

4.1 FXYCS

The Japanese large-value transfer system for international payments is the Foreign Exchange Yen Clearing System (FXYCS) (Japanese Bankers Association 2000). Its operations effectively begin the global payment day because it is the major system that functions immediately west of the international date line. The system began operating in 1980 and it is owned by the Tokyo Bankers Association. The multilateral net positions of institutions participating in the FXYCS are calculated continually until 2 p.m., at which point the settlement procedures involving accounts held by participants at the Bank of Japan commence. For this reason, the FXYCS is characterized as being a deferred net settlement (DNS) system. The credits (for net receivers) and debits (for net senders) which are made to the settlement accounts of the participants at the Bank of Japan at 3 p.m. are irrevocable and final.

4.2 EAF

A number of national large-value transfer systems in the European time zone are used extensively for cross-border payments. In Germany, for example, the system that is most frequently used for such transactions is called Elektronische Abrechnung mit Filetransfer (EAF); "Abrechnung," i.e., reckoning up, translates easily as "clearing." (The acronym EAF is now interpreted as Electronic Access Frankfurt.) In contrast with the Japanese system just described, in which an association of private bankers played the pivotal role as the developing agency, the EAF is a creation of the German central bank. The system dates from 1990, and it has gone through several transformations. For example, the EAF started as a DNS system, but now is in the process of integration with a second Bundesbank payment mechanism, a real-time gross-settlement (RTGS) system (i.e., one in which each completed payment message immediately leads to a negative and a positive change in the settlement accounts of the sending and receiving banks held at the central bank).

4. For detailed descriptions of most of these systems, see BIS (1990a). It includes a number of comparative tables.

4.3 SIC

The national payment system for large-value transfers that is most strongly oriented to international payments is the SIC. Indeed, approximately 90 per cent of the value processed by the SIC on an average day will occur only if the U.S. payment system is also open. This orientation reflects the very high dependence of the Swiss economy on both trade and financial flows across borders, as well as the many ways in which the Swiss franc and Swiss institutions serve international purposes. The SIC began operations in 1987. It was the first large-value funds transfer system to incorporate a queuing mechanism that stores (and can later process) any message that initially fails to pass risk-control checks—in particular, the real-time verification of sufficient settlement balances to cover the out-payment. The SIC resulted from the Swiss National Bank working with the major banks and, notably, their jointly owned telecommunications and data-processing corporation, called Telekurs.

4.4 SNP

In France, in the second half of the 1990s, two large-value funds transfer systems appeared in tandem: Transferts Banque de France (TBF), and Système Net à Paris (SNP). The first is an RTGS system owned and operated by the central bank, and the second is a DNS system designed to handle the numerous cross-border transactions of the French banks, including both foreign exchange settlements and third-party French franc payments coming from correspondent banks. The French banks were adamant that the substantial value flows of cross-border business should be processed as economically as possible, and they believed that the collateral amounts necessary to risk-control their DNS arrangement would be significantly lower than in the proposed RTGS system. The compromise was to build both.

4.5 CHAPS

Operating one time zone to the west of the main continental European large-value transfer systems is the United Kingdom's Clearing House Automated Payment System (CHAPS). CHAPS is a long-standing and continually evolving facility of the U.K. banking industry's Association of Payment Clearing Companies, and the system functions on a real-time, gross-settlement basis. This RTGS feature—not often characteristic of systems developed in the private sector—was a direct result of the strongly expressed preference of the Bank of England, and it reflected the desire of both the private and public institutions in London to be in a position to efficiently process payments denominated in euros in the cross-border context. In practice, this meant there had to be a U.K. RTGS system linked to TARGET, the RTGS system for euro-denominated

payments that is operated by the European Central Bank. CHAPS, and in particular "CHAPS euro," provided the link.

4.6 CHIPS

Five time zones further to the west, across the Atlantic and into the time zone relevant for most North American financial transactions, is CHIPS. It is the oldest—and by far the biggest—of the relevant national large-value transfer systems (LVTSs). It was developed in the late 1960s by the New York Clearing House Association explicitly to clear international U.S. dollar payments. CHIPS was until very recently a DNS system—the calculated net positions of each participating institution at the end of the day being used in an early evening settlement procedure that involved Fedwire transfers creating debits or credits to accounts they held at the Federal Reserve Bank of New York.[5]

The average value of the payments passing through CHIPS on a typical day is truly massive; it was US$1,448 billion per day in 1997. As will be explored in Section 5, the corresponding *global* total was about twice the CHIPS number. The factor of about 2 not only reflects the role of the U.S. dollar as the main vehicle currency in world trade, but also reflects the two-currency nature of all foreign exchange transactions. (In a simplified world in which all trade contracts were written in dollars, if all trade payments were associated with equal foreign exchange purchases and sales, then the activity in CHIPS would be the "mirror image" of all the G-LVTN activity elsewhere in the world.)

4.7 LVTS

Also located in the Eastern time zone of North America is Canada's LVTS. This relatively new large-value transfer system, which began operation in 1999, is a guaranteed net settlement system; i.e., a system that provides intraday certainty with respect to the settlement (the equivalent of a claim on the central bank) for any payment message that passes the risk-control tests.[6] The LVTS is a direct descendant of the earlier Canadian facility called the Interbank International Payment System (IIPS), and it continues to have a strong international orientation. The average daily value of LVTS payment messages drops by almost two-thirds on a day when CHIPS is closed for a U.S. holiday that is not shared in Canada (such as Thanksgiving Thursday).

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5. Changes in the CHIPS daily settlement procedures in 2001 are described by the Payments Risk Committee (2000).
6. See Dingle (1998).

The nature and names of the various national large-value transfer systems relevant to a study of cross-border payments change over time. One representative and somewhat larger set, based on the relevant systems existing in the Group of Ten countries in 1997, is used for statistical purposes in the next section.

5. The Global Value and Volume of Large Cross-Border Payments

Since the risk in any payment context is directly (although not exclusively) related to the value flowing in the relevant time interval of one business day, it is well worth trying to estimate the daily value of the global stream of cross-border payments. Boxes 1 and 2 in this section present rough approximations; taken together, they suggest that the daily average value of cross-border large-value payments was some US$3–$5 trillion in 1997. This section also addresses two current developments that may lead to a noticeable—but possibly only temporary—reduction in the global payment flows. A main source of data for this empirical exercise is the 1998 version of *Statistics on Payment Systems in the Group of Ten Countries*, hereafter called the *Statistics*.[7]

The overall impression made by the two estimates taken together is one of very large scale—trillions of U.S. dollars in over a million transactions occurring globally every business day. This order of magnitude for the daily flow of cross-border large-value payments helps establish the potential scale of certain types of payment-system risk. Subsection 8.2 uses the estimates to complement a description of a related policy initiative, namely the international effort to control foreign exchange settlement risk.

7. See BIS (1998). It presents data for the year 1997.

Box 1 Estimated Daily Average Payment Flows—Based on SWIFT Messages

The "global" total for the *volume* of large-value cross-border transfers moving via the G-LVTN equals the number of SWIFT payment messages during the period in question. (Telex messages are now quite rare.) This number is found by adding the information listed in Table 15 of the *Statistics* for each of the eleven countries covered. Messages in SWIFT categories I and II (i.e., both clients' transfers and interbank transfers) are relevant. Dividing the annual total of 231 million SWIFT messages by a conventional number of 250 business days in a year gives almost 1 million messages per day, on average, during 1997.

The average dollar amount conveyed in a SWIFT credit-transfer message is somewhere between US$1 million and US$10 million. (In comparison, the average amount of a transfer over CHIPS was US$6.1 million in 1997, and the average size of a payment over the LVTS in Canada is currently about US$5 million.)

Using these similar figures of roughly US$5 million as the global average amount per transfer, and multiplying by 1 million messages per day, one gets US$5 trillion as the estimate for the *value* of the "global" flow of payments facilitated by the SWIFT network on an average day. This large number can be seen to be plausible when one compares it with either the US$1.4 trillion average daily value flowing through CHIPS in 1997 or the flow of foreign exchange transactions of US$2 trillion per day surveyed by the BIS in 1998.

Box 2 A Second Estimate of the Daily Average Value Flow—Based on National Totals

An alternative estimate, also based on the *Statistics*, is obtained by adding the reported daily value numbers for selected national large-value transfer systems that are unquestionably components of the G-LVTN; i.e., those located in major economies and used primarily for international trade and financial transactions. The eleven systems used for the estimate were ELLIPS (Belgium), IIPS (Canada), SNP (France), EAF2 (Germany), Ingrosso (ex SIPS in Italy), FXYCS (Japan), TOP (Netherlands), RIX (Sweden), SIC (Switzerland), CHAPS (United Kingdom), and CHIPS (United States), all as defined in Table 10a of the BIS *Statistics*. The decisions to add CHIPS (but not Fedwire) for the United States, the FXYCS (but not BOJ-NET) for Japan, and the SNP (but not TBF) for France were straightforward, given the specialization of those systems. But the choice of exactly which other systems should be included in the global total is not as clear. It is a matter of detailed institutional knowledge, and there is probably no fully satisfactory selection.

The addition of the annual average value flow for each of these large-value payment systems, as published for each one in Table 10a of the BIS *Statistics*, divided by 250, gives a figure of almost US$3 trillion per day.

The measured values and volumes of large-value cross-border payments have been rising rapidly as a result of the globalization of financial markets (described in Section 9) and the rising relative importance of international trade for national economies. But there are two countervailing factors that will cause a downward adjustment in the corresponding international payment flows. First, the planned move in 2001 to *Continuous Linked Settlement* should lead to a reduction in the substantial portion (about one half) of the average value of US$3–$5 trillion per day for large-value cross-border payments that is accounted for by the bilateral settlements of banks' foreign exchange purchase and sale transactions, for which annual growth rates of 10–20 per cent have been observed in recent years. Second, there is the tendency for more and more cross-border transactions to flow from payer to payee entirely on the books of particular banks that specialize in the processing of such transactions for other banks. This second development is an aspect of the *consolidation* phenomenon, discussed in subsection 9.3. The following paragraphs elaborate on these countervailing factors.

Continuous Linked Settlement

Contemporary technology allows a payment mechanism not only to transfer value, but also to conduct simultaneous and complementary calculations on the flow of information contained in each payment message. Moreover, communications networks allow such complementary calculations to occur in real time, virtually anywhere, and at reasonable cost. Relevant examples of this sort of computer application are found in the Euro 1 and euroSIC arrangements described in Section 3, and in a number of clearing or netting arrangements in use in various countries around the world (Dingle 1993). And netting, by definition, reduces the number of payments needed to conduct a given volume of business.

Continuous Linked Settlement (CLS) represents the current phase in this evolution. The following description of CLS traces what happens to a single hypothetical exchange-market transaction that is settling as part of the daily CLS Bank procedures.[8] Two banks that are participants in the Continuous Linked Settlement Services agree to a purchase and sale transaction involving foreign exchange, say U.S. dollars against Japanese yen. According to temporal conventions (described below) the eventual settlement of this transaction will involve payments in the two national systems that are relevant, in this case CHIPS and FXYCS. The two banks send standardized messages confirming the transaction to one another over the SWIFT network. Copies of these will be routed automatically to the CLS computer facility in Bournemouth, England. When two messages reflecting a particular trade are precisely matched, the amounts to be transferred in the two currencies in question will be fed into the CLS risk-control and settlement procedure. On the settlement day, in five 1-hour intervals beginning at 7 a.m. to 8 a.m. Central European Time (hence 1 a.m. to 2 a.m. in eastern North America), each "side" of the transaction will be placed in a listing of items for settlement during one of the hour-long intervals. If the example's purchase and sale transaction was the only one registered in the two national contexts in that 1-hour interval, then by 2 a.m. Eastern Time the bank owing dollars would route a final payment to the account of a special-purpose institution, the CLS Bank, held at the U.S. central bank. By the identical deadline, the bank owing yen would route a final payment to the credit of the CLS Bank at the Japanese central bank. At 2 a.m. Eastern Time, if the two necessary transfers had arrived, the two central banks (upon the authorization of the CLS Bank) would send final payments in their national currency to the two banks that had sold foreign exchange.

This hypothetical case of one and only one foreign exchange transaction cannot, by definition, involve the netting of two or more deals. Thus one must enrich the example and add at least

8. For a fuller introduction to CLS, see Mundt (1997/98). Current information is available from http://www.cls-services.com.

one more foreign exchange deal, say between the same two parties in the same amounts but going in the opposite direction. In this case, the CLS Bank calculations in Bournemouth of the amounts payable by each participating bank in the settlement sequence leading up to 2 a.m. Eastern Time do involve netting; i.e., payables are reduced by receivables in each of the currencies in question. The amounts routed to the two central banks are net amounts, not gross amounts. It is noteworthy that, even in this simple example, the value passing through the relevant national payment systems of the G-LVTN—CHIPS and FXYCS in this case—drops by the combined value of the two foreign exchange transactions as a direct result of the use of CLS via the CLS Bank. The 100 per cent decline in this simple example depends on the fact that the net flows to and from the central banks move over Fedwire and BOJNET—systems largely focused on domestic large-value transfers and hence not counted in the G-LVTN arithmetic described in this section.

Efforts have been made to answer the fully detailed empirical question: "What fraction of the global flow of cross-border payments will disappear as a result of the operations of the CLS Bank?" Guesses range from as low as 10 per cent to well over 50 per cent. A knowledgeable judgment with respect to one key element is contained in the study of the combined payment-system impacts of the introduction of the euro, the CLS Bank, and the revised settlement procedures in CHIPS (Payments Risk Committee 2000). The study suggests that up to 30 per cent of the daily value in CHIPS will be eventually processed via CLS. By using the relationship of "mirror images" outlined in subsection 4.6, one could forecast that the global total of international payments will also drop by about 30 per cent.

Consolidation

A major U.S. consulting firm has forecast that about five large institutions will handle two-thirds of the world's correspondent banking business within five years (Shah 1997/98). As the number of institutions in a financial system declines (for example, as a result of mergers), it follows that—given the same amount of underlying economic activity—there will be fewer transactions in the interbank payment systems, and more payments that result in a debit to one client's account and a credit to another client's account, both occurring on the books of the same institution. While such consolidation would cause a decline in both of the two above estimates of the global sum of cross-border payments, the aggregate level of risk could be lower *or higher* as a result, depending on the soundness of the consolidated institutions through which the payment flows are increasingly being channelled. This topic is addressed further in subsection 8.5.

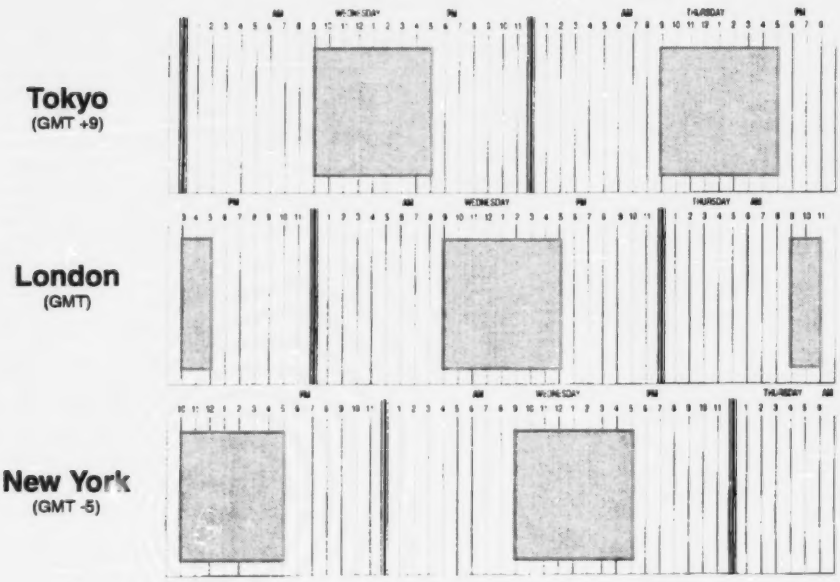
6. Temporal Elements

Temporal matters such as time zones and national business hours are important considerations in making cross-border payments. Some important details of the global network derive from the intersection of payment-system operating schedules and the number of hours separating, say, the closing time of the FXYCS in Tokyo from the closing time of CHIPS in New York. There are a number of excellent maps of the world that show the international date line (running north and south in the mid-Pacific) as well as the 24 time zones and how each relates to Greenwich Mean Time (GMT).[9]

6.1 Business and trading hours

Figure 1 summarizes the way in which the business and trading hours of the major centres of the world partially overlap.[10]

Figure 1: Global Market Operations
Time Zone Relationship



9. One example is in *The Times Atlas of the World* (1985, Plate 8).
10. This figure was used by G. Snyder of the Federal Reserve Board at the 1989 International Symposium on Banking and Payment Services in Washington, D.C. (The 9-to-5 characterization of business and trading hours in all three areas was chosen to simplify the vertical interpretation of the figure.) See also footnote 12.

Figure 1 indicates how the London trading hours overlap the New York trading period by some three hours. Of particular interest is the hour that begins at 11 p.m. (Tokyo time), 2 p.m. (London time), and 9 a.m. (New York time), and lasts until midnight in Japan. This is an important interval of time for the global managers of short-term financial assets and liabilities, because it affords the last unambiguous opportunity for a Japanese institution to, say, ask a New York bank to cover an unhedged position with a dollar transaction that is "for value" that day. An order given one hour later from Japan would clearly settle in the United States that same day, but an order given three or four hours later might be too late for the funds to be made available to the beneficiary in New York before the close of business that afternoon.

In this context it is important to note that the country of the principal vehicle currency—the United States—is located in the western extremity of the world, as defined by the international date line. This permits the trading days of Tokyo and London to be completed long before the relevant U.S. payment-settlement process concludes that evening in New York. One can express this idea slightly differently by stating that the CHIPS settlement cycle terminates at about 7 p.m. Eastern time in North America, which is simultaneous with the 9 a.m. opening of the subsequent Tokyo calendar day. (The 14-hour gap becomes 13 hours during daylight saving time during the summer in New York). A technical delay of an hour in the completion of the CHIPS settlement process has on occasion caused an equal delay in the opening of the Japanese money market. This is because the participants in any money market want to know—with certainty—the levels of their operating balances as measured at the close of the preceding day. Otherwise, they cannot make trading decisions for the current day without added risk.

The most recent application of this type of graphical presentation of the important trading and payment-system operating hours was produced in the months leading up to the beginning of the year 2000 (Board of Governors of the Federal Reserve System 1999). The Monetary Authorities Communications Services (MACS) functioned at that time as a depository for information regarding the exact hours of operation, holiday closures, and New Year's weekend testing intervals for the main payment mechanisms in a number of countries, as well as for the major securities-clearing systems.

6.2 Dating conventions in major short-term markets

Since cross-border payment flows are predominantly caused by transactions in the foreign exchange market and in the interbank deposit markets, the observed value of such payments each day closely reflects the underlying activity levels in these two contexts. Box 3 describes the

market conventions that determine the schedule of peak days, and helps explain the short-run variations in payment-system risks of all types.

As a result of these foreign exchange and deposit market conventions, a noticeable fraction of a full month's value flow occurs in most national payment systems on the last business day of the month (and on the immediately following business day). Moreover, long weekends and national holidays occurring at or near the month-end will amplify this pattern. A complex example is provided by the Good Friday and Easter Monday holidays, which may or may not span the March month-end, which is importantly also the end of the Japanese banking year. Payment-related facilities such as SWIFT have to be prepared for peak *volumes* on those days. Similarly, the peaking of *value* flows at or near month-ends, often reaching twice the average daily amounts, suggests that the value of payments involved in a month-end default situation would be substantially greater than in a similar situation occurring a few days earlier or later. Thus the various payment-system risks addressed in Section 8 are also likely to be at their highest at such times.

6.3 The G-LVTN—Intraday

The focus of this subsection shifts away from the temporal factors that help determine the flow of value in the global network for large-value transfers *on* a particular day, and considers instead the pacing of that flow of value *during* a particular day. Clearly the opening, and particularly the closing, hours of the relevant national payment systems are significant for any participant who is waiting to be paid. Some large-value transfer systems experience congestion at certain points during the day. A particular payment may be delayed—for example, held in a waiting queue—because the sending institution is momentarily constrained by a risk-control provision such as a net debit maximum.

In addition to these intraday traffic-flow considerations, an incoming payment may or may not be "final" at a particular point in time, owing to the laws and rules governing the particular system. A payment is final when the recipient (i.e., beneficiary) of the funds transfer can know with certainty that it has irrevocable and unconditional access to the amount involved.

Box 3 Dating Conventions in Foreign Exchange and Interbank Deposit Markets

Foreign exchange markets have long-standing conventions regarding the number of days that elapse between two traders' agreement to a transaction and the subsequent "settlement" on the "value date"; i.e., the movements of value between the buyer and the seller in the two national payment systems involved on a specified future business day. (These settlement lags allow time for market participants to arrange any necessary funding, or to prepare investment actions.) For example, a "spot" exchange transaction involving U.S. dollars and pounds sterling occurring on a Monday will typically settle two days later on Wednesday, provided there is no banking holiday in either the United States or the United Kingdom on that day. A holiday in either country causes an additional day's delay in that case. Similar two-day conventions exist for many other countries including Japan, Germany, and Switzerland. On the other hand, the settlement lag is only one day for Canada–U.S. transactions.

A second important convention used in the forward and swap foreign exchange markets regards the exact future date of an outright forward or swap transaction that is characterized as being a "one-month" deal, for example. The forward value date is based on the *spot* value date for the two currencies in question, say 10 July, plus the one month ahead to a tentative forward value date of 10 August. If, however, 10 August is not an eligible day because of holidays or a weekend, the convention then tentatively identifies the subsequent business day. But there is an important exception. If these steps produce a tentative value date falling just into the subsequent calendar month, then the value date is advanced in time to the mutual business day that immediately precedes the tentative date. This refinement reflects common terms and conditions found in many financial contracts, for example, those governing loan repayments and interest payments.

The interbank deposit markets of the world, and in particular the Euro-currency deposit market, establish the exact maturity date of, say, a one-month term deposit by using the convention described above for a one-month forward exchange transaction. A similar convention is used for "month-end" (to month-end) datings. The harmonization of the datings in the exchange and money markets of the world reflects the fact that many foreign exchange purchases are combined with a virtually simultaneous investment of the proceeds in a term deposit denominated in the newly acquired currency. Similarly, a maturing term deposit will often be used to finance a purchase of exchange on precisely that day—perhaps in turn because there is an underlying commercial transaction or balance-sheet "window-dressing" transaction to be done shortly before the month-end.

The question of whether a particular payment is final must be addressed in a similar manner on two levels: first, at the level of the sending and receiving banks; and, second, at the level of the ultimate beneficiary who is a client of the receiving bank. A funds transfer is immediately final in those payment systems using well-designed RTGS procedures (as defined in Section 4). The logic is as follows: If the receiving bank has just been informed that a transfer has occurred, then that institution knows with certainty that its settlement account at the central bank has just experienced a credit in the amount of the transfer. If the credit is legally irreversible, and since there is no chance that the central bank can ever be in default, the funds transfer is final. Consequently, the receiving bank can, without risk, enter an irreversible credit into the account of its client, the ultimate beneficiary.

An incoming transfer passing through a DNS system (as defined in Section 4) may or may not be judged to involve the same certainty. The word "deferred" indicates that the payment-system settlement process, during which the accounts of participating institutions held at the central bank are credited or debited in the appropriate net amounts, may occur a number of hours after the receipt of the payment message itself. In some systems the settlement sequence occurs on the subsequent business morning, which often means after two or three days, owing to weekends and holidays. Moreover, in a default situation, a receiving bank could be faced with a situation in which the payments from a defaulting participant must be unwound. It is unlikely that a bank would allow beneficiary clients unconditional access to incoming funds in such payment systems.

It is, however, entirely possible to construct a DNS system in such a way that finality of payment can be extended to the beneficiaries. This is the case in the Canadian LVTS, for example, where fully committed collateral provided by the participating institutions covers or exceeds the largest possible multilateral net deficit of any one participant at all times. Moreover, the highly unlikely situation involving the default of two or more institutions within the system's operating hours on the same day is addressed by a guarantee of settlement extended by the Bank of Canada. Not only is there immediate "certainty of settlement" with respect to any credit-transfer message accepted by the system, but the Canadian Payments Association bylaws governing the system require that a receiving institution must promptly and finally credit the account of the beneficiary with the amount of the transfer.

The varying chance of congestion, and the presence or absence of finality with respect to a payment at a particular moment in time, both depend on the precise nature of the payment system through which the funds are moving. Consequently, many banks active in cross-border transactions devote resources to maintaining up-to-date and detailed information about the situation in each of the relevant systems in which they participate—CHIPS, FXYCS, EAF, etc.

7. Key Questions in the Global Context

When one considers the public-policy aspects of large-value cross-border payment transactions, two broad questions need answering: (1) What are the necessary (or highly desirable) characteristics of the global network for large-value funds transfers? (2) How should the global community best work to assure that these characteristics are present in the G-LVTN?

7.1 The characteristics of a "good" payment system

The first question has of course been asked numerous times with reference to one or other *national* large-value transfer system.[11] The answers indicate a number of important characteristics, which can logically be combined into clusters, as follows:

(i) speed and timeliness

(ii) certainty and reliability

(iii) efficiency and cost-effectiveness

(iv) openness and presence of competition

(v) information provision and information protection

Each of these five characteristics is described briefly below, using the assumption that one is dealing with a national system such as CHIPS or the FXYCS. Then subsection 7.2 examines the same five topics in a global context. The degree of complexity rises sharply in the world environment. Any characteristic that is a challenge to enhance in a national context involves a Herculean task when approached globally.

(i) *Speed and timeliness*. Increasingly, we live in a "real-time information-processing" world. Thus a contemporary national large-value payment system has to transfer value from the institution serving the payer to the institution serving the payee in a matter of seconds. Although speed *per se* is generally desirable, the more focused characteristic is timeliness. In today's world, corporate treasurers and the "cash managers" of major financial institutions must be able to act (specifically, make a payment satisfactory to the payee) in a narrow time-window. For example, the end-of-cycle settlements which must be made each day by the participants of securities-clearing arrangements typically must occur within a specified hour. The national LVTS must provide a

11. For example, see Crow (1992).

sufficiently timely service to permit such scheduled settlements to occur without frequent extensions of operating hours.

(ii) *Certainty and reliability.* In the national context, the degree of certainty with which a transfer passes value from payer to payee depends on both legal and operational details. Numerous questions arise in the minds of the wary user: Can the payer stop the payment? In other words, is the payment irrevocable? In the event of default on the part of the institution serving the payer, do payments get reversed? Is the credit to the account of the payee associated with the receipt of a payment made unconditionally (i.e., is the payment final)? Is the system over which the payment is passing stable, robust, and reliable? Have there been noticeable outages? If so, why?

(iii) *Efficiency and cost-effectiveness.* An efficient national LVTS will necessarily provide for timely, accurate, secure, and reliable transfers of value from one participant to another. But if it does so at a cost that is perceived by the users to be well beyond the resulting benefits, it will not be a cost-effective system. Users will rationally turn to cheaper (and possibly more risky) payment media.

(iv) *Openness and presence of competition.* A national LVTS tends to be open whenever the access criteria that determine which types of financial institutions may become participants are based on objective, reasonable, and published parameters. Some economists conclude that a more open system will also be a more efficient and cost-effective one. (Substantial economies of scale might, however, alter this conclusion.)

(v) *Information provision and information protection.* The standard for providing account-balance levels and transactions-flow information to clients active in national markets is now quite high—approaching real-time calculation and availability. This service level is supported by real-time accounting systems, used in conjunction with computer-to-computer linkages between banks and their corporate clients. Data and privacy protection are similarly advanced in many countries. In several areas, including notably the European Union, legislation establishes requirements regarding the assembly, retention, and acceptable use of data about individual clients or corporations.

7.2 A "good" payment system for cross-border transfers

Now consider the same five necessary or highly desirable characteristics of a large-value transfer system or network in the global context. It is immediately evident that the amount of relevant institutional information rises by a factor equal to the number of major national systems. In addition, one must absorb information concerning the many ways that banks wishing to effect an

international payment combine national payment systems with cross-border links of one kind or another to do so.

(i) *Global speed and timeliness.* Since many international payments still move along a chain of correspondent banks with smaller institutions employing their national large-value transfer system as a link in the chain, speed and timeliness can depend directly on the summation of the relevant processing intervals in each case. Contributing to the sum are time-zone differences, operating hours, and the lags (if any) before each intermediary transfer leads to the final crediting of the account of the ultimate beneficiary. The total might imply that finality occurs on the next business day, which in turn might well be four calendar days later. Analysts obtain such detailed temporal information from published charts of the sort presented in Section 6. Owing to the ongoing evolution of all national payment systems, such charts change over time and should bear a precise date.[12] The charts would help answer a question about a particular large-value payment originating in, say, Germany in late morning and destined to its U.S. correspondent to "cover" a U.S. dollar transfer in the United States via CHIPS to the bank of the ultimate beneficiary, perhaps in a city other than New York. If a default is declared with respect to the German bank at 1 p.m. Central European Time, is there a break in the chain? Or have all the component transfers been (irrevocably) credited to each intermediary and to the payee? At what time precisely can one say that the payment is final? Such matters help determine speed as well as certainty in the G-LVTN context.

(ii) *Global certainty and reliability.* The legal and operational questions that must be answered in a particular national context to know with certainty that payment is final must be repeated in a global context, at least with respect to those nations relevant for the particular payment in question. When one is dealing with a cross-border payment, it may sometimes be difficult to determine which country's laws apply to a particular aspect of the transaction. There may indeed be a debate about the exact nature of the transaction and hence about what laws should apply. Both sides in a conflict situation will naturally use details that place them in a preferred position. The resolution of such questions under international law can take many years, in part because there is no accepted court of appeal for private disputes. In the meantime, one side of the argument has the benefit of the cash—and the accumulating interest revenues.[13]

In comparison to the *legal* situation, the determination of the degree of *operational* certainty in the global context is closer to a compilation of the relevant details regarding the robustness of the various computer and communications systems used in the relevant national contexts

12. A good example (as of August 1993) is shown in BIS (1993, 15).
13. See Collier (1994) on "conflict of laws."

and in the international linkages of various types. The reasons for major outages (and the corrective measures) are usually made public, and judgments regarding operational certainty can then be adjusted appropriately.

(iii) *Global efficiency and cost-effectiveness.* Occasional efforts have been made to measure the relative cost-effectiveness of national payment systems by estimating the ratio of the annual costs (of developing and operating both retail and wholesale system components) divided by gross national product. Ratios of between 1 per cent and 3 per cent have been so obtained. Would a comparable global measure based on each of the national percentages (perhaps a weighted average) be adequate? The answer is "No." Such a measure would probably omit the costs of the *links* between the national systems, including the costs caused by the greater complexity of the cross-border institutional structures, the costs associated with the lower degree of legal certainty, etc. An economic study of the *links* could include an assessment of the efficiency gains derived from the centralized approach that has been used in the more recent cross-border arrangements such as Euro 1 and euroSIC.

(iv) *Global openness and presence of competition.* One might conclude that a low level of competition at some point along a chain of correspondent banks might also reduce the level of competition in the G-LVTN, at least in the case of transfers involving that particular point. The theory of oligopolistic competition would seem to support this view in the following way. Payers initiating a cross-border transfer from a country characterized by oligopolistic competition in the provision of payment services would likely pay a service fee higher than the marginal cost of the transfer to the bank that originates it. (The order of magnitude of the fee for an international corporate transfer is currently about US$10, within a wide range reflecting the relative bargaining powers of large and small corporations.) Any efficiencies that prevail further down the chain of correspondent banks as a result of more "open" structures in other countries would probably not improve the position of the payer.

There is a second way in which imperfect competition can occur in the global context—specifically, in the consolidation of the correspondent banking industry into the hands of a small number of "global clearing banks." Instead of chains of correspondents linking the payer's institution to several other banks and finally to the payee's bank, the novel pattern involves a very large institution with direct operational capacity and full legal status in most of the national LVTSs that comprise the G-LVTN. More and more international payments are tending to begin and end their transit from country to country on the books of just one such bank, perhaps HSBC, Chase, or Citibank. Anticipated economies of scale based on the continuing sharp relative (indeed, absolute) declines in the costs of computation and telecommunications are driving this development. The

broad topic of increasing concentration in the financial sector globally has recently been addressed in an international policy forum, as described in Section 8.

(v) *Global information provision and information protection.* Internationally active corporate clients of banks are at least as anxious to know the status of their transactions as the managers of financial assets and liabilities are in a national context. The uncertainties and complexities of cross-border business imply that the international players have to devote additional resources in order to know promptly the exact status of each transaction. In addition, there may be a narrow time-window in the national financial markets in which to react to payment messages coming from a time zone to the east, for example. It is thus not surprising that the Internet is already being used by over a third of the world's correspondent banks to provide both transaction reporting and real-time balance reporting to their corporate clients (Toone 1997–98).

Information protection in the global context involves an extra degree of tension between the concern to protect the privacy of clients on the one hand and the need to constrain money laundering on the other. Criminal activities such as the drug trade or credit card fraud are often organized on a cross-border basis, and the individuals involved demonstrate considerable ingenuity in using international funds transfers as an element in moving, concealing, and transforming the proceeds of crime. As a partial response, there is now a global initiative to enhance the content of the standardized third-party credit-transfer message so as to include (in machine-processable form) the identity of the originator of the transaction. In turn, national agencies for the analysis of suspicious transactions could use the data in their calculations and in the compilation of evidence regarding money laundering in particular cases.

8. Global Policy Initiatives of the Last Decade

Policy initiatives of global scope and addressing the challenges outlined in the preceding section are relatively recent phenomena, essentially beginning in the early 1990s. This section looks briefly at all five of these initiatives, in chronological order: (1) refining payment-netting schemes, (2) reducing foreign exchange settlement risk, (3) increasing operational reliability, (4) extending the best practices in LVTS design, and (5) addressing the increase in financial consolidation.

8.1 Refining payment-netting schemes

The "Minimum standards for the design and operation of cross-border and multi-currency netting and settlement schemes," the so-called Lamfalussy standards, were published by the governors of the central banks of the Group of Ten countries in November 1990 (BIS 1990b). Each of these

standards can be associated with one or more of the necessary or highly desirable characteristics of a large-value transfer system, described in Section 7. As a complete package, the six standards work to reduce "*systemic*" risk; i.e., the risk that a default (or non-settlement for purely technical reasons) on the part of one institution may cause a second institution to fail to settle, and hence perhaps a third, etc., in a domino effect. The six Lamfalussy standards are described below.

(I) Netting schemes should have a well-founded legal basis under all relevant jurisdictions.

This standard addresses the need for certainty with respect to the rights and responsibilities of all relevant parties to an international funds transfer. The potential for problems based on insufficiently clear national legal treatments of the netting of large-value transfers has been reduced in recent years by new pieces of legislation, for example the Payment Clearing and Settlement Act in Canada, and by the publication (and slow adoption) of a "model law" for international credit transfers developed under the aegis of the United Nations.[14]

(II) Netting scheme participants should have a clear understanding of the impact of the particular scheme on each of the financial risks affected by the netting process.

This standard also addresses certainty by encouraging comprehensive analyses of the ways in which novel structures can alter significantly the credit exposures and liquidity positions of banks active in the cross-border payments business. The more the risks about participation in a particular system are understood, the better will be the risk-management practices.

(III) Multilateral netting systems should have clearly-defined procedures for the management of credit risks and liquidity risks which specify the respective responsibilities of the netting provider and the participants. These procedures should also ensure that all parties have both the incentives and the capacities to manage and contain each of the risks they bear and that limits are placed on the maximum level of credit exposure that can be produced by each participant.

This standard refers implicitly to the information-provision capacities of any payment or netting mechanism. It also demands that banks establish procedures to contain two specific types of risk—the risk that an incoming payment is significantly delayed, and the risk that the payment will never be received. Widespread compliance with this standard increases the certainty of daily outcomes for all participants.

14. See the report by the United Nations (1991).

(IV) Multilateral netting schemes should, at a minimum, be capable of ensuring the timely completion of daily settlements in the event of an inability to settle by the participant with the largest single net-debit position.

Standard IV works to enhance certainty by appropriately strong default-handling rules and procedures that usually involve collateralization. The standard also helps to ensure that large-value transfer systems are capable of timely operations even when a participant is under financial stress.

(V) Multilateral netting schemes should have objective and publicly-disclosed criteria for admission which permit fair and open access.

This encourages greater openness and larger numbers of participants in any netting mechanism, and ideally increases the level of competition—hence likely also the efficiency—in the provision of payment services.

(VI) All netting schemes should ensure the operational reliability of technical systems and the availability of back-up facilities capable of completing daily processing requirements.

This final Lamfalussy standard addresses both the certainty of operations under adverse physical conditions and the timeliness of funds transfers within the hours still remaining in any business day after an operational problem has occurred.

Shortly after the publication of these standards for cross-border and multi-currency netting schemes—indeed, in one case before—national authorities and central banks were seen to apply them as well in their assessments of *domestic* systems for large-value transfers.[15] Consequently, their global impact has been both broad and deep.

8.2 Reducing foreign exchange settlement risk

The task of controlling and reducing the risks associated with foreign exchange related payments was the major preoccupation of the central banks of the Group of Ten countries during the second half of the 1990s. The basic problem had been long understood, and it can be simply explained.

Whenever a typical (interbank) foreign exchange purchase and sale transaction comes to settlement, either one or two days following the agreement made by the pair of market participants involved in the trade, two associated events must occur in two national payment systems,

15. See, for example, the Federal Reserve System (1987).

typically in the particular LVTSs that are components of the G-LVTN. In one system, a credit transfer denominated in currency 1 is routed to the bank that purchased that particular currency. In the second system, a credit transfer denominated in currency 2 is routed to the other party to the transaction, namely the seller of currency 1. The risk comes from the possibility that one of the two "sides" of the deal will be significantly delayed or, worse still, fail to take place at all when the other is completed.

The scale of such risk was correctly viewed as being extremely large. The global flow of large international payments was estimated in Section 5 as between US$3 trillion and $5 trillion on an average day; of this, about half can be accounted for by foreign exchange settlements. (The other half are the various correspondent banking transactions that often reflect commercial payments such as the basic example of a cross-border transaction described in Section 2.) The gross outflows of a major bank on a single day could often exceed its capital. Indeed, the outflow *to a single counterparty* could occasionally reach this order of magnitude. It was therefore necessary to encourage all banks active in foreign exchange to act in such a way that any outgoing settlement would only be made (with finality) with appropriate caution—until the incoming settlement in the second currency was virtually certain to occur, also with finality. The differences in time zones, LVTS operating hours, and times at which payments became final became subjects of close study. One particularly instructive and high-profile case involved significant losses of capital: in 1974, a small Cologne institution, the Bankhaus Herstatt, received domestic currency settlements in the morning, but was declared insolvent by its regulatory authority later on the same business day—which prevented Bankhaus Herstatt from making its contracted outpayments denominated in U.S. dollars. The recipients lost the full principal value of their deals. The collapse of the Bankhaus Herstatt was reported in the press to have cost its foreign exchange counterparties over US$620 million.

The massive scale of foreign exchange settlements, and the added complexities reflecting the international nature of the transactions (with the time zone, legal, and technical aspects often not fully understood), clearly generated a significant degree of systemic risk. The "domino" scenario, unfolding in the global context, spurred the actions of the community of central banks.

Both foreign exchange settlement and systemic risks were subsequently addressed in a series of reports published by the BIS, and in due course supervisory guidelines for the management of settlement risks were issued by BIS in cooperation with the relevant regulatory authorities in the Group of Ten countries. The first report, *Settlement Risk in Foreign Exchange Transactions* (published in 1996), provided an analysis of the problem and called on individual banks and industry groups to improve business practices and devise safe mechanisms by which to address settlement risk. The second document, *Reducing Foreign Exchange Settlement Risk: A Progress*

Report (1998), concluded that significant progress had been made by the private sector, but that more work needed to be done. The development of CLS, and the establishment of the CLS Bank, represent the principal private-sector initiatives in this area. The CLS Bank is scheduled to begin operations in 2001.[16]

The responsibility for the control of foreign exchange settlement risk is widely shared. It involves the national banking supervisors (as guided by the Basel Committee on Banking Supervision), the central bankers concerned with promoting safe and efficient infrastructure (via the initiatives of the BIS Committee on Payment and Settlement Systems), various banking industry groupings, and—perhaps most importantly—the individual financial institutions. Unfortunately, when a responsibility is widely shared, there can be questions about who has the primary responsibility. Partly as a result, risk-control initiatives can proceed slowly at times.[17]

8.3 Addressing operational risk—Oversight of SWIFT

The worldwide banking-industry cooperative called SWIFT, which provides the telecommunications facility for the great majority of cross-border large-value transfers, was described briefly in Section 2. SWIFT is the central operational context for the more than 1 million third-party and interbank payment messages that move globally on an average day; very few global networks process more than 1 million messages per day (one of them is the IATA network, which processes air travellers' reservations). Were SWIFT inoperative, there would be no immediately available global payment mechanism for trade and finance, and transactions levels would drop to minimal levels until services resumed. Every day this continued, the receipt of about 1/2 per cent of the annual export revenues of the world would be delayed. Many of the numerous associated financial transactions would similarly be held in suspension.

Do central banks have a role to play in preventing such circumstances? The answer has been a guarded "Yes"—the element of caution coming from the moral hazard that would be created if the central banks' stance was noticeably more proactive. (Moral hazard is the temptation experienced by managers to become less risk-averse than would otherwise be the case because of the presence and possible aid of a committed and resourceful agency.)

The solution found by the central banks on the CPSS was to audit not the operational reliability of SWIFT, but the processes used by SWIFT itself to audit and reinforce the reliability of its systems. Working groups of central bank technical experts now meet with their SWIFT counterparts on an annual basis, with the National Bank of Belgium acting as "lead overseer."[18]

16. Challenging issues faced by the participating banks are described by KPMG-LLP (2000).
17. See the press release issued by the BIS (2000).
18. See the National Bank of Belgium (1999, 107–108).

Informal meetings of the management of SWIFT and the members of the CPSS occur about once per year.

8.4 Extending the best practices for LVTS design

In 1998, the CPSS established a broadly based Task Force to articulate a set of core principles to guide the design and operation of systemically important payment systems within all countries. Part 1 of their report (BIS 2001) states ten principles, which are presented in summary form below. Seven of the principles are thoughtful expansions of the Lamfalussy standards cited in subsection 8.1, while three give general guidance on appropriate settlement assets, effective governance, and the practicality of the payment mechanism for its users in the particular economic system in question. Part 1 of the Task Force report also outlines four responsibilities for central banks that choose to apply the core principles.

Part 2 of the report gives detailed information that should prove useful for the implementation of the principles, including examples of issues that must be resolved, and various ways those issues have been addressed in particular contexts.

The publication of the core principles is timely. In 1998, a survey (Fry et al. 1999) of 70 countries determined that 45 of them either had or were planning to build a large-value transfer system. The sharing of the experiences of the score of countries that have constructed sophisticated and reliable large-value transfer systems can save other nations a great deal of time and resources. Moreover, the world community is dealing with an evolving whole, and the hope is to make all the elements of the global system as sound as possible.

In this light, consider the ten core principles for the design of a systemically important payment system within a country:

(I) The system should have a well-founded legal basis in all relevant jurisdictions.

This principle is virtually identical to Lamfalussy standard I, except for the shift in focus from a "netting scheme" to a "systemically important payment system." As subsection 8.1 indicated, this statement addresses the need for certainty with respect to the roles and responsibilities of the various participants in the system.

(II) The system's rules and procedures should enable participants to have a clear understanding of the system's impact on each of the financial risks they incur through participation in it.

This principle is virtually identical to Lamfalussy standard II, except again for the change in context. Note that a specific reference to "rules and procedures" has been added. These documents articulate and formalize such important aspects as default-sharing responsibilities, and they must be crystal clear to be effective in periods of financial stress.

(III) The system should have clearly defined procedures for the management of credit risks and liquidity risks, which specify the respective responsibilities of the system operator and the participants and which provide appropriate incentives to manage and contain those risks.

This principle uses wording similar to Lamfalussy standard III, while achieving a greater degree of generality. The explicit requirement that limits be placed on "the maximum level of credit exposure that can be produced by each participant" is replaced by a description of the variety of ways in which credit and liquidity risks can be managed and contained.

(IV) The system should provide prompt final settlement on the day of value, preferably during the day and at a minimum at the end of the day.*

This principle, together with the next one (which also bears an asterisk), captures the requirement of Lamfalussy standard IV that the system be capable of ensuring the timely completion of daily settlements—even in adverse circumstances. In addition, it modifies "settlement" with the important words "prompt," "final," and "on the day of value," and employs a footnote to encourage the designers of payment mechanisms to *exceed* the minima specified.

(V) A system in which multilateral netting takes place should, at a minimum, be capable of ensuring the timely completion of daily settlements in the event of an inability to settle by the participant with the largest single settlement obligation.*

This wording is very close to that of Lamfalussy standard IV, in that it focuses on multilateral netting mechanisms (which are often used in the national mechanisms that are components of the G-LVTN, as noted in Section 4), and on the potential order of magnitude for the value to be provided, pursuant to the rules and procedures, with respect to the one participant having the largest settlement obligation on any day.

(VI) Assets used for settlement should preferably be a claim on the central bank; where other assets are used, they should carry little or no credit risk and little or no liquidity risk.

This is an entirely new statement. The intent is to eliminate, or at least minimize, the risk associated with the particular asset used by participating institutions to settle their obligations arising in the course of system operations. The use of balances held at a central bank makes excellent sense, owing to the freedom from any risk of default on the part of that institution. There are now in existence, however, sophisticated "quasi-systems" (which are not treated explicitly in the core principles), that use balances on deposit at a private-sector institution for settlement purposes. The term "quasi-system" describes a structure that bears a close functional resemblance to a national LVTS, yet is installed in an institution that specializes in providing payment and settlement services to banks. For example, the settlement assets used in the euroSIC are claims on the Swiss Euro Clearing Bank, the private special-purpose bank established in Frankfurt now operating under the supervision of the German authorities. (See subsection 3.5.)

(VII) The system should ensure a high degree of security and operational reliability and should have contingency arrangements for timely completion of daily processing.

This paraphrases Lamfalussy standard VI. Readers with computer backgrounds or particular interest in the technical aspects of payment systems will find the elaboration of this principle in Part 2 of the report particularly useful.

(VIII) The system should provide a means of making payments which is practical for its users and efficient for the economy.

This principle is truly novel. For the first time, a person working in, say, Africa, can read this statement about doing what is "practical" for the many users of a payment system—conceivably the complete adult population of their country—and read the down-to-earth advice (in Part 2) about how to avoid payment-system inefficiencies of national scale.

(IX) The system should have objective and publicly disclosed criteria for participation, which permit fair and open access.

This is virtually identical to Lamfalussy standard V.

(X) The system's governance arrangements should be effective, accountable and transparent.

This new principle underlines the importance of good governance for any agency creating or operating important portions of a country's financial infrastructure. Part 2 of the report presents

some of the tools of effective governance, and illustrates how they have been applied in contrasting institutional contexts, both private and public.

In summary, the ten core principles for the pursuit of safety and efficiency in systemically important payment systems are the product of a significant broadening and deepening of central-bank views on such matters over the course of the 1990s. Any national payment system that can be considered an element of the G-LVTN (for example, the seven national systems described in Section 4) are by their very nature "systemically important." Some of these have been formally examined by the International Monetary Fund, and found to comply with the core principles. Several other elements of the G-LVTN (for example, the CLS arrangements and the euroSIC), while not fitting the strict definition of a systemically important payment system, merit study in the light of the ten core principles.

8.5 Addressing the increase in financial consolidation

A most noticeable and thought-provoking financial phenomenon at the beginning of the millennium is the consolidation process within this sector in most major economies. This trend can be seen as the organizational outcome of both globalization and the liberalization of financial activity, developments which in turn have been spurred by the availability of ever-cheaper information technology. From this perspective, the substantially greater concentration in the financial industry may be a welcome development, promising greater efficiency and hopefully better service to the users of financial services. On the other hand, financial consolidation can also concentrate the loci of risk, and the results must therefore be monitored closely. (A parallel example of such monitoring occurs in the Lamfalussy standards of 1990, which addressed the concentration of risk that is a potential consequence of the introduction of any cross-border netting mechanism.) A second worrisome aspect is the awareness that, at some point, the increasing concentration may produce oligopolistic behaviour, less-than-vigorous competition, excess profits, and a drag on further innovation. As long as there are perceived (and often actual) economies of scale that push financial firms to merge with and acquire other companies, there is also a possibility that the consolidation momentum will be excessive, herd instincts will produce self-inflicted harm, and failures will occur in structures of systemic importance.

In this context, a Working Party on Financial Sector Consolidation was established in 2000 under the auspices of the Group of Ten finance ministries and central banks. The intention was to produce an interim report for the Ministers and Governors by the end of that year (Group of Ten 2001). Six specialized task forces were established to assist in this effort, one being the

Task Force on the Effects of Financial Sector Consolidation on Payment and Settlement Systems. (The individual members of this group were usually also members of the CPSS.)

The Group of Ten report concludes that there are still further cost savings to be derived from mergers and from various other forms of consolidation. The markets for payment, clearing, and settlement services appear to still be contestable. The users of such services therefore seem likely to enjoy some share of the anticipated efficiency gains following the many organizational changes. Some cautionary notes are, however, appropriate. First, there is often a trade-off between increased efficiency and increased systemic risk as one moves toward fewer institutions combined into larger structures. Second, the recent consolidation experience took place during a strong economic expansion, with correspondingly robust bank profits being experienced in many cases. The organizational and human strains caused by mergers are widely recognized to exist, but they are sometimes ignored as a factor that can temporarily weaken operational arrangements. When economic growth slows, profitability usually declines, and credit risks correspondingly increase for financial institutions. Speculative (bearish) transactions tend to move through the clearing and settlement systems of the world in surges, and in such an uncertain environment there may well be some unanticipated failures. Moreover, such failures might be of a technologically novel nature. (The scenarios examined for the year-end 1999–2000 provide hints in this regard.)

9. The Future of the G-LVTN

9.1 Further globalization

Globalization in recent years has reflected varying combinations of the following actions: (i) the pursuit of perceived economies of scale to be gained by producing goods and services for the global market, (ii) the response to the more homogeneous demand conditions, which reflect an emerging world culture (in turn supported by the global communications and entertainment industries), and (iii) the use of information technology by corporations and institutions to organize their activities in numerous countries simultaneously. What is emerging is a comprehensive cross-border orientation of firms' strategies, management procedures, and business operations. In this evolution, particular national details are gradually subsumed in the broader picture.

The financial aspects of further globalization seem likely to include a number of already well-established patterns: (i) the heavy reliance on U.S. dollar denominated transactions, often combined with foreign exchange transactions because of the need of businesses to move continually in and out of national currencies such as the yen and the euro, (ii) the use of sophisticated ways of hedging against foreign exchange risk in a world characterized by floating rates, and (iii) the need

for global corporations to raise substantial amounts of capital, hence relying heavily on the deepest available—and usually dollar denominated—financial markets. Correspondingly, financial intermediaries sell the majority of newly issued securities into these same markets. The use of international securities depositories appears likely to grow in relative importance, as does the use of global trading systems. All three of these patterns produce substantial flows of cross-border payments.

The main implications of further globalization for the G-LVTN are easy to identify. The volumes and values of payments moving through the cross-border links are very large and growing quickly. This may continue despite continuous net settlement and the appearance of global clearing banks. In the face of the growth in, and the procedural reorganization of, cross-border payments, the infrastructure of the G-LVTN has to evolve in such a way as to provide sufficient capacity in an efficient and cost-effective manner, while remaining suitably risk-proofed. In part this is the concern of the particular national authorities focused on the relevant national payment systems such as CHIPS, FXYCS, etc. In part also it is the concern of the broader group of players including bank supervisors who are involved with the elements that lie *between* the national systems, in particular the correspondent banking relationships and the more recent types of interbank arrangements described in Section 3.

9.2 Expected applications of information technology

The international credit transfer is an operation that continues to lend itself to standardization. The information components are few in number, many of them are solely numeric in nature, and what is alphanumeric in form is usually brief. The basic (third-party) international credit-transfer message standard covers the amount of the payment, the currency in which it is denominated, the value date, the payor, the payee, and the various banks involved. Some of the data fields of the message contain information that is mandatory; without such information the message cannot be sent. Other data fields contain optional information that is often alphanumeric and recorded in free format. The complete message is designed to be brief in order to be as economical as possible. (This contrasts sharply with an Electronic Data Interchange (EDI) payment transmission, which may contain several thousand bytes of information needed by the accounting personnel of the receiving banks and corporations.)

The future application of information technology in the payments area seems likely to proceed in a largely uncoordinated way—just as it has in the past. (The standardization of the credit-transfer message in the 1970s set the scene for numerous additional computer applications in both the preparation of messages at the sending bank and the subsequent processing of messages at the

receiving bank.) The gradual assembly of new pieces of relevant software in numerous institutions over decades resembles the growth of a coral reef; it is the gradual emergence of a complex structure—the reflection of an "ecology," not a plan.

The near-future stage of this technological evolution with respect to international payments will be focused on the processing that occurs within the receiving bank whenever the account of a payee is credited with the amount of the transfer. A last piece of the full configuration of relevant standards is about to be set in place. Until now, there has been an insufficiently standardized identifier of the (account number of the) ultimate beneficiary. As a result, there has been a blockage with respect to the use of "straight-through processing," or STP, for the crediting procedure. Steps are now being taken under the aegis of the International Standards Organization to establish an international bank-account-number standard, adding a country code to whatever the national account-number standards currently specify. Thus one can confidently forecast an extension of STP into the procedures used for crediting payees' accounts. On the surface, this extension of information processing technology seems easily justifiable on economic grounds. But there is a question concerning the risks involved.

Imagine yourself working in the receiving bank. The decision to credit a client's account with a large amount of incoming funds—in international banking, as in banking generally—merits the attention of a competent bank officer. This is because the client is highly likely to initiate outpayments (possibly final) in a matter of hours. Several elements are relevant for the decision: Have the funds arrived in a transfer that is final? Perhaps the incoming payment is being held in a queuing procedure of the system through which it is coming. If so, is collateral about to be pledged, perhaps to a central bank, that will allow the release of the payment? Would an immediate crediting of the client's account be irrevocable? Would the client be immediately informed? What is the current or typical level of funds in the client's account, and what would be the chances of reversing a credit entry? Is an overdraft beyond a line of credit likely? There is no doubt that some banks are well aware of the risks created by crediting beneficiaries' accounts in advance of the arrival of the funds. But there is clearly a trade-off between the risks that the receiving banks face on the one hand, and their corporate clients' satisfaction at prompt service on the other. In the coming years, some banks will simply expand their application of STP and move to immediate crediting. Other banks may choose to use STP plus an "expert system" that in effect replicates the analysis and decisions of a typical bank officer. (One central bank in Europe has already built such a system.) This may be an opportunity for thoughtful guidance from a prudential perspective.

9.3 Further consolidation—in diverse forms

The forces that have led financial institutions to consolidate over the last decade are very much still in evidence. New applications of information technology promise *economies of scale*, as suggested by the fact that emerging global correspondent banks are described as "transactions factories." Second, the increasingly *homogeneous global demand* for contemporary financial services is exemplified by the worldwide popularity of networks of shared ATMs, which offer travellers convenient access to their funds, instantly converted into the local currency. Third, the use of contemporary technology to *manage* a financial institution *on a worldwide basis* is well illustrated by the fact that the HSBC owns its own communications satellites for such purposes.

Consolidation in international banking now takes a variety of forms. One sees mergers and acquisitions, alliances, joint ventures, co-sourcing, and outsourcing. Mergers and acquisitions across borders do occur, although somewhat less frequently than within countries. (No doubt cultural and legal complexities help account for this difference.) Alliances are seen clearly in the two new cross-border arrangements called Euro 1 and euroSIC (described in Section 3). Joint ventures would seem to be the predominant way in which banks are organizing themselves to operate in the world of e-commerce and the Internet. In these cases, banks often obtain the necessary security arrangements for their Internet banking services from highly specialized and technologically sophisticated corporations, which are probably quite happy to be acting jointly with a major bank. Finally, a significant example of a joint venture which is relevant for international banking is seen in the SWIFT's recent initiative with IDENTRUS to support secure cross-border transactions over the Internet.

The current rapid pace of consolidation in banking and finance also reflects legislative developments. For example, the European Union's move to a common currency on 1 January 1999, and the ceasing of payments in Deutschmarks, French francs, etc., in January 2002, mean that a long-standing rule of thumb—that a correspondent bank is needed in each significant country—no longer strictly applies. This situation is being assessed by banks both inside and outside the European Union. It has become possible to choose just one highly specialized bank to function as correspondent throughout Europe, or alternatively to join one of the two newly established eurobanking arrangements mentioned in the last paragraph. Legislative reform in the United States allowing cross-state banking is having a similarly consolidating effect on correspondent relationships within that country. The final outcome of these trends will not be seen for several years.

9.4 A suggestion for future consideration

The most important message of this working paper is that a global network exists for large-value cross-border funds transfers, whether or not one is aware of it. The label G-LVTN directs our thought toward that global network and the policy issues it raises.

It would be useful if one could assemble the detailed rules and procedures of: (i) those national large-value transfer systems such as CHIPS and FXYCS that handle predominantly cross-border transfers, and (ii) the operating rules and contractual relationships of the various major cross-border arrangements, such as Euro 1 and the euroSIC. A compendium of this material could be maintained by an international institution such as the BIS. The compendium would be current, precise, translated into English, and made available globally in electronic form. This action would, in effect, continually refine the definition of the G-LVTN, and hence support a variety of private and public purposes related to the safety and soundness of the global payment system.

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